

***Tetratheca exasperata* and *T. phoenix* (Elaeocarpaceae), two new conservation-listed species allied to *T. setigera*, from south-west Western Australia**

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**Abstract**

Butcher, R. *Tetratheca exasperata* and *T. phoenix* (Elaeocarpaceae), two new conservation-listed species allied to *T. setigera*, from south-west Western Australia. *Nuytsia* 17: 117–126 (2007). The two new species described here are similar to *Tetratheca setigera* Endl. in having the upper part of the pedicel, the receptacle and the calyx segments densely ornamented with long, red, glandular setae. *Tetratheca exasperata* R. Butcher differs most readily from *T. setigera* in its almost glabrous leaves, with strongly revolute margins, and very short, patent stem hairs. This taxon has been infrequently collected from three areas in the Jarrah Forest and Avon Wheatbelt regions and has a Priority Three conservation listing. *Tetratheca phoenix* R. Butcher differs from *T. setigera* in its almost glabrous, but prominently tuberculate, stems and densely glandular-hairy ovary. This taxon is restricted to Mt Cooke, c. 70 km south-east of Perth and has a Priority Two conservation listing. These two new species are described and illustrated here, and their distributions are mapped.

**Introduction**

*Tetratheca* Sm. comprises 35 taxa in Western Australia, 22 of which are currently listed as Priority or Declared Rare Flora under the Department of Environment and Conservation's (DEC) Conservation Codes for Western Australian Flora (Western Australian Herbarium 1998–; Atkins 2006). One species previously recorded from the Wheatbelt is now listed as Presumed Extinct. Thompson's (1976) revision of the genus recognised eight new Western Australian species, all with five or fewer cited specimens, many with highly restricted distributions. Of these, one species is no longer considered distinct, but six of the remaining seven have current conservation listing, with little or no expansion of their geographic range recognised since their description. Recent taxonomic work (Alford 1995; Butcher & Sage 2005; Bull 2007, this issue; Butcher 2007a; Butcher 2007b, this issue) has confirmed that highly localised distributions and natural rarity are common features of many Western Australian species. Coupled with habitat loss through agricultural land-clearing, mining and other past and current threatening processes, it is sobering that all 11 new taxa described since 1995 are currently listed as Priority or Declared Rare Flora (Western Australian Herbarium 1998–; Atkins 2006).

The two new species described here show closest morphological affinity to *T. setigera* Endl., a widespread and variable species from south-west Western Australia that is the subject of ongoing taxonomic investigation (T.D. Macfarlane pers. comm.). *Tetratheca setigera* varies in the pubescence

of stems and leaves, the presence or absence of glandular setae on the pedicel, receptacle and calyx segments, the degree of expansion of the pedicel apex into the receptacle, the width of the receptacle and stamen morphology, particularly, the degree of constriction between the anther body and tube and the length of the anther tube. Some morphological variation appears to be geographically correlated, with a 'typical' form widespread from Dwellingup to Augusta and Nornalup and divergent collections occurring mainly in the Walpole-Nornalup and Albany regions.

Despite the wide variation in *T. setigera* and the need for further work to fully resolve and clarify this, two new, allied taxa can be clearly discriminated and are described here. *Tetratheca exasperata* R. Butcher has three disjunct areas of distribution in the Jarrah Forest and Avon Wheatbelt regions. *Tetratheca phoenix* R. Butcher is known only from Mt Cooke, c. 70 km SE of Perth on the Darling Scarp. Both species are relatively uniform and differ from *T. setigera* in details of leaf morphology and stem, leaf and flower indumentum. Both new species have a Priority ranking under the Conservation Codes for Western Australian Flora.

Both of these new taxa are also allied to *T. fasciculata* Joy Thomps., which is listed as Presumed Extinct in Western Australia (Atkins 2006). Only two specimens (including the holotype) of *T. fasciculata* have been collected and extensive searches have failed to relocate this taxon (S. Patrick pers. comm.). Study of the holotype of *T. fasciculata* ("sources of Blackwood River", Miss Cronin 1889, MEL 1008329) and the second specimen ("near Lake Wagin", Miss Cronin 1895, MEL 1008410) has confirmed the distinctness of this species from *T. setigera* and the species described in this paper.

## Methods

All specimens of *Tetratheca* housed at the Western Australian Herbarium (PERTH) were examined as well as selected specimens, including type material, on loan from the National Herbarium of Victoria (MEL) and the Royal Botanic Gardens, Sydney (NSW). Herbarium acronyms follow Holmgren & Holmgren (1998–), except for ALB., DKN. and KJP. which represent the Western Australian regional herbaria at Albany, Darkan and Kojonup, respectively. Habit, stem, foliage and colour characters were taken from herbarium specimens, with floral characters measured from reconstituted flowers.

For ease and accuracy of comparison with previously described species (see Thompson 1976; Alford 1995; Butcher & Sage 2005; Butcher 2007a), descriptive terminology follows Thompson (1976). A notable exception is the use of pedicel, rather than peduncle, for the flower stalk. One important diagnostic character requires clarification, however. Thompson's descriptions of the stamens refer to three visible parts; the filament, which varies from filiform to broad and greatly reduced in length; the anther "body" (Thompson 1976: 149), which is enlarged and formed from the four fused anther cells; and the anther tube, which is the unilocular terminal portion of the stamen from which pollen is released from all four cells via a common aperture. The specific and relative sizes of these three parts, as well as their vestiture and colour, and their respective connexions—which contribute to the overall shape of the stamens—all have high taxonomic value. As such, Thompson's distinction between the three parts, and her terminology, is retained here. A range of stamen morphologies illustrating the diversity of forms of each of these parts is shown in Thompson (1976: 150). Attention is also drawn to Figure 1D where the distinction between the 4-celled anther body and the terminal anther tube is evident.

The distribution map was created using DIVA-GIS freeware Version 5.2.0.2 (<http://www.diva-gis.org/>)

and shows the Interim Biogeographic Regionalisation of Australia (IBRA) Version 6.1 boundaries (Department of the Environment and Water Resources 2007) applicable to south-west Western Australia. Precise localities have been withheld from all cited specimens due to conservation concerns.

## Taxonomy

### *Tetradthea exasperata* R. Butcher, *sp. nov.*

*Tetradthecae setigeræ* Endl. similis sed caulibus pilis patentibus rigidibus brevissimis subter setis rigidis sparsis, foliis  $\pm$  glabris marginibus valde revolutis differt.

*Typus*: south-south-east of Duranillin, Western Australia [precise locality withheld for conservation purposes], 5 October 2006, V. Crowley DKN 1104 (*holo*: PERTH 07477880!); *iso*: CANB!, K!, MEL!, NSW!).

*Tetradthea* sp. Duranillin (V. Crowley 976), Western Australian Herbarium, in FloraBase, <http://florabase.dec.wa.gov.au> [accessed 20 August 2007].

*Sub-shrub*, 0.1–0.35 m high, 0.05–0.4 m wide. *Stems* few, openly and alternately branched, slender, leafy, terete, straight, apices indeterminate, terminal branchlets 40–201 mm long, 0.6–1.15 mm wide in flowering region, olive green, tinged with pink, to red-brown below light pinkish-grey to grey wax on younger stems, older stems dull, pale olive-green or green-brown to red-brown, longitudinally rugulose, with a moderate to dense, even covering of short (0.01–0.1 mm long), white, patent, non-tubercule-based, simple hairs and sparse to moderate, long (0.6–1.4 mm long), stiff, red to red-brown,  $\pm$  patent, tubercule-based glandular setae, these often concentrated at stem bases and below leaves, setae falling with age to leave a white-cream tubercule remnant. *Leaves* alternate, persistent, moderately to densely arranged, ascending to adpressed to stem, often with a single seta on, or at the base of, the petiole and/or with two setae in a  $\pm$  stipular position; petiole fleshy, inserted above small raised area of stem, 0.25–0.6 mm long, pink-red to red below pinkish-grey or grey wax, sometimes with short simple hairs or acute tubercules along margins; blade linear, lanceolate or narrowly elliptic, 2.3–9.7 mm long, 0.5–2.3 mm wide; apex acute to obtuse, often terminating in a short point; margins thickened to strongly revolute, entire, sometimes appearing dentate due to scattered marginal glandular setae; adaxial surface pale, dull green, glabrous or with a few very short, simple hairs or small, acute tubercules towards apex or scattered throughout, glaucous, wrinkled; abaxial surface pale, dull green, glabrous or with a few very short, simple hairs or small, acute tubercules towards apex, glaucous, midvein raised at the base, becoming depressed into the lamina at the apex. *Flowers* single in leaf axils. *Bracts* 2 or 3, linear to lanceolate, 0.5–1.3 mm long, 0.1–0.3 mm wide, red to dark red, few simple hairs along margins and at the apex on both surfaces. *Pedicels* straight at base and gently curved into receptacle, occasionally strongly curved at base, 6.6–12.5 mm long, 0.25–0.8 mm wide, with thickened longitudinal ridges in upper 1/3 to 1/4, golden-pink to red, light orange-brown to pink-red at apices of thickened longitudinal ridges, sometimes paler or becoming green towards receptacle, glabrous in lower 2/3 to 3/4, upper portion with dense, stiff, red, glandular setae (0.75–0.95 mm long) arising at the apices of ridges, sometimes glaucous, finely striate, tapering along length before expanding suddenly into a receptacle 1–1.7 mm wide; receptacle densely covered with  $\pm$  decurrent ridges terminating in stiff, red, glandular setae. *Calyx* segments 5, rarely 4, inserted at the apex of the receptacle, thickened and folded at base, deciduous by early fruit formation, narrowly oblong-elliptic to narrowly ovate, 2.5–4.4 mm long, 1.3–2 mm wide, slightly concave, apex usually acute, gently recurved; margins slightly thicker,

slightly recurved; outer surface pink to dark pink,  $\pm$  glabrous with occasional large, raised tubercles or stiff setae, these usually concentrated at the base; inner surface  $\pm$  glabrous, with some very fine, straight hairs towards margins, mid-vein prominent. *Petals* 5, rarely 4, deciduous, spatulate to obovate, 7.6–12.8 mm long, 4–6.7 mm wide with the widest point at *c.* 2/3 length, apex usually rounded with a small triangular fold from centre, dark pink to pink-purple. *Stamens* usually 10, less commonly 8, rarely 11, 2.5–3.8 mm long, free; filaments thick, wedge-shaped, straight to angled, 0.1–0.2 mm long, pink to red, glabrous; body gently curved from the filament on inner edge, then  $\pm$  straight and with a smooth transition into the tube above, outer edge strongly curved and expanded at base above filament then straight with a smooth transition into the tube, 1.6–2.6 mm long, pink to red, smooth or with scattered small tubercles or short, simple hairs on margins of cells, mainly in the lower 2/3; tube arising smoothly from the body on inner and outer edges, usually incurved, 0.7–1.25 mm long, orifice narrow to moderately open, oblique, lower edge longer than the upper, pink to red, sometimes paler towards apex, smooth. *Ovary* broadly ovate, compressed, with a thickened rim at base, tapering into the style at apex, 1.4–1.85 mm long, 1.05–1.45 mm wide, pale pink to red, glabrous externally and internally; *style* straight, 1.4–2.1 mm long, yellowish pink to pink, paler at apex, glabrous; *stigma* shortly papillose; *ovules* 2, 1 in each locule, attached near the apex of the septum, placentation not prominent. *Mature fruit* not seen. *Seed* not seen. (Figure 1)

*Other specimens examined.* WESTERNAUSTRALIA: [localities withheld] Jarrah Forest: 22 Sep. 1995, V. Crowley DKN 352 (PERTH 04743903); 25 Sep. 1995, V. Crowley DKN 351 (PERTH 04743911); 2 Oct. 1999, V. Crowley DKN 976 (DKN., PERTH 05779111); 22 Oct. 1985, E.J. Croxford 4555 (ALB., PERTH 04399668); 27 Sep. 2000, C.M. Lewis 485 (KJP., PERTH 05888867); 10 Oct. 2001, C.M. Lewis 534 (KJP., PERTH 06094708). Avon Wheatbelt: 24 Oct. 1986, E.J. Croxford s.n. (PERTH 02941813); 24 Oct. 1997, T.D. Macfarlane TDM 2015 (PERTH 04724542); 26 Oct. 1982, K.H. Rechinger 59097 (PERTH 02962314), 59099 (PERTH 02818116).

*Distribution.* *Tetralthea exasperata* occurs between Bowelling and Kojonup, *c.* 200–300 km SSE of Perth, in the Jarrah Forest region, and near Tincurrin, *c.* 200 km SE of Perth, in the Avon Wheatbelt region (Figure 2).

*Habitat.* This taxon has been collected from white to grey sand and sandy loam with gravel, as well as from orange-brown gravelly loam soils. In the Jarrah Forest region, *T. exasperata* occurs in *Eucalyptus marginata* and *E. wandoo* woodland with *Dryandra sessilis*, *D. preissii*, *Billardiera* sp. and *Nemcia* sp., while in the Avon Wheatbelt it has been collected from dense heath comprising *Dryandra proteoides* and species of *Banksia*, *Adenanthos* and *Melaleuca*, with scattered, emergent *Nuytsia floribunda*.

*Phenology.* Collected in flower from late September to late October, with fruits developing from late October.

*Conservation status.* Recently listed as Priority Three under DEC Conservation Codes for Western Australian Flora. *Tetralthea exasperata* is known from only 11 collections, none of which are from conservation reserves. Plant numbers range from one to occasional at all sites where the abundance of this species has been recorded.

*Etymology.* The specific epithet refers to the stem vestiture (*L. exasperatus*—covered with short, hard points).

*Affinities.* *Tetralthea exasperata* is most similar to *T. setigera* and these two species are evidently



Figure 1. *Tetralthea exasperata*. A – holotype (V. Crowley DKN 1104); B – stem detail showing very short, simple hairs, long, stiff, tubercule-based setae and tubercular remnants clustered below the leaf scar; C – solitary, axillary flowers, with glabrous leaves observable; D – dissected, rehydrated flower showing stiff setae on the receptacle, stamen morphology, glabrous ovary and short, straight style. Ovary dissected on one half to show single ovule per locule. All images taken from the holotype. Scale bar = 5 cm (A), 0.5 mm (B), 1.5 mm (C), 1 mm (D).

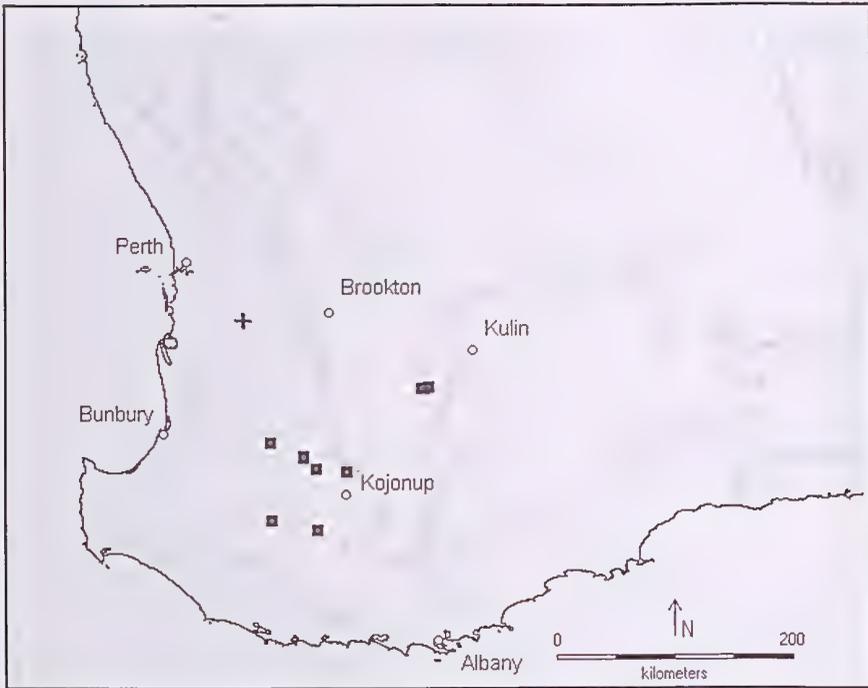


Figure 2. Distribution of *Tetratheca exasperata* (■) and *T. phoenix* (+) in south-west Western Australia.

closely related. Shared characters include the stiff setae on the stems and the concentration of these around the leaves and nodes, the glandular setae on the upper part of the pedicel and receptacle, the shape and relative lengths of the staminal parts, and the glabrous ovary. *Tetratheca exasperata* can be differentiated from *T. setigera* by its leaves, which are densely arranged, pale, dull green, usually glaucous and glabrous to glabrescent, with strongly revolute margins and a smooth to slightly wrinkled adaxial surface. By comparison, the leaves of *T. setigera* are openly spaced, prominently discolourous with a paler abaxial surface, variable in indumentum, but usually prominently strigose, and lack strongly revolute margins. The stems of *T. exasperata* have sparser setae and these overlies very short, patent, stiff, white hairs, rather than short, wavy, soft, white hairs, as seen in *T. setigera*. The character of different stem hairs in combination is also used to distinguish *T. hispidissima* Steetz (red-brown setae over short, straight, white hairs) from the variable and closely related species *T. hirsuta* Lindl. (dense, white, curled hairs (when present) below the setae).

Florally, *T. exasperata* is very similar to the most widespread and common form of *T. setigera*, in having a setose pedicel and receptacle, and the outer edge of the stamens curved more or less smoothly from the filament to the anther tube. *Tetratheca exasperata* differs from *T. setigera* by the greater density of coarser setae at the apex of the pedicel and on the receptacle, and in having shorter, usually incurved anther tubes and a greater frequency of hairs on the anther body. Both species have a glabrous ovary with one ovule per locule, however, in *T. exasperata* the inner surface of the ovary is glabrous and each ovule is attached near the apex of the axis with a small placenta, while in *T. setigera* the inner surface of the ovary has hairs in the upper part and each ovule is attached c. 2/3 of the way along the axis with a placenta that is usually enlarged.

In the east of its distribution, *T. exasperata* occurs close to the known range of the Presumed Extinct species *T. fasciculata*. *Tetradheca fasciculata* can be distinguished from *T. exasperata* by the very thick rootstock and fascicled stems, which have more slender, antrorse setae as well as moderately long, fine, wavy, white hairs, and hispid leaves. Additionally, in *T. fasciculata* the pedicels are straight at the base and strongly curved just below the flower with an abrupt transition into the receptacle, which is almost circular in outline. The pedicel, receptacle and calyx segments bear red, glandular hairs, rather than setae. The flowers are typically 4-merous and the ovary is densely pubescent externally, with hairs extending along the style for c. 1/3–2/3 of its length.

***Tetradheca phoenix*** R. Butcher, *sp. nov.*

*Tetradhecae setigerae* Endl. similis sed caulibus tuberculis papilliformibus et raro pilis glanduliferis brevissimis (sine setis rigidis), calyce dense setoso glandulifero, ovario pilis glanduliferis differt.

*Typus*: Mt Cooke, Western Australia [precise locality withheld for conservation purposes], 13 October 2006, R. Butcher & N.D. Burrows RB 1157 (*holo*: PERTH 07220626; *iso*: CANB, MEL).

*Tetradheca* sp. Mt. Cooke (N.D. Burrows MC110), Western Australian Herbarium, in FloraBase, <http://florabase.dec.wa.gov.au> [accessed 20 August 2007].

*Sub-shrub*, c. 0.25 m high, c. 0.05 m wide. *Stems* few, alternately branched, slender, leafy, terete, straight, apices indeterminate, terminal branchlets 35–165 mm long, 0.6–0.9 mm wide in flowering region, dull olive green, not glaucous, rugose to broadly striate when dry, covered in small, rounded to papillose tubercles, with scattered short (0.15–0.2 mm), stout, tubercle-based, red-tipped glandular hairs at stem bases and on younger stems. *Leaves* alternate to sub-whorled, sometimes apparently opposite-decussate, persistent, moderately dense, ascending to adpressed to stem; petiole thickened, 0.1–0.35 mm long, pale yellow-cream, glabrous; blade linear to very narrowly elliptic, 3.9–12.4 mm long, 0.6–1.3 mm wide; apex acute to obtuse, terminating in a short point or small glandular hair; margins entire, strongly revolute; lower leaves sometimes crenate with short, stout, red-tipped glandular hairs scattered along margins at projections; adaxial surface light green to light olive-green, glabrous or with very short simple hairs or acute tubercles towards apex or scattered throughout, not glaucous, smooth to slightly wrinkled; abaxial surface paler light green, glabrous, slightly glaucous, mid-vein prominent. *Flowers* single in leaf axils. *Bracts* paired, linear, 0.4–0.8 mm long, c. 0.1 mm wide, light pink-brown becoming green, simple short hairs along margins and at apex on both surfaces. *Pedicels* sharply curved at base then  $\pm$  straight, gently curved into receptacle, 4.5–6.4 mm long, 0.25–0.7 mm wide, with thickened longitudinal ridges in upper 2/3 to 3/4, red with pale yellow-green areas at apices of thickened longitudinal ridges, glabrous at base to lower 1/3, upper portion with dense, stiff, dark red, glandular setae (0.5–3.5 mm long) arising at the apices of ridges, not glaucous, very finely striate at base, expanding gradually along length and expanding into a receptacle 1.25–1.55 mm wide; receptacle densely covered with  $\pm$  decurrent ridges terminating in stiff, dark red, glandular setae. *Calyx* segments usually 5, less commonly 6, inserted at apex of receptacle, persistence not known, elliptic, 2–2.9 mm long, 1.2–1.75 mm wide, slightly concave; apex acute; margins  $\pm$  flat; outer surface dark purple-red, covered with long (1.7–2.3 mm), red, tapering, glandular setae and fine white spots; inner surface with simple hairs along margins and at apex, mid-vein raised. *Petals* usually 5, less commonly 6, persistence not known, broadly obovate, 10.8–11.4 mm long, 6.1–6.9 mm wide with the widest point in the upper 1/3, apex rounded with a small triangular fold from centre, dark pink-magenta. *Stamens* usually 10, less commonly 12, 3.2–3.3 mm long, free; filaments thick, wedge-shaped, angled, 0.3–0.35 mm long, pale pink-cream, glabrous; body gently curved from the filament on inner edge,  $\pm$  straight for a short distance then incurved into the tube, outer edge broadly curved from filament then  $\pm$  straight,

passing smoothly into the tube, 1.9–2.1 mm long, dark red, glabrous but rough textured; tube arising smoothly from the body on the inner and outer edges,  $\pm$  straight to gently curved on the outer edge, gently curved on the inner edge, 0.9–1 mm long, orifice moderately open, oblique, lower edge longer than the upper, dark red, glabrous but rough textured. *Ovary*  $\pm$  circular to ovate, compressed, with a thickened rim at base, passing quickly into style at apex, 0.9–1.3 mm long, 0.8–1.1 mm wide, yellow to pale pink, densely covered with ascending, long, glandular hairs, puberulous along margins and at apex, glabrous internally; *style* straight, 2.1–2.3 mm long, dark pink, paler pink at apex, glabrous or puberulous just at base; tapering into a shortly papillose *stigma*; *ovules* 2, 1 in each locule, attached near the apex of the septum, placentation not prominent. *Fruit* not seen. *Seed* not seen (Figure 3).

*Other specimens examined.* WESTERNAUSTRALIA: [localities withheld] 2 Oct. 2004, N.D. Burrows MC110 (PERTH 07017553); 13 Oct. 2006, R. Butcher & N.D. Burrows RB 1158 (K, NSW, PERTH 07220634); 23 Sep. 2005, R.J. Cranfield 21690 (AD, HO, MEL, NSW, PERTH 07492227).

*Distribution.* Collected only from Mt Cooke, c. 70 km south-east of Perth on the Darling Scarp (Figure 2).

*Habitat.* *Tetratheca phoenix* grows in a mid- to upper-slope position in brown gravelly loam soil over granite, often near large outcrops. Occurs primarily in *Eucalyptus marginata* forest with a mid to low understorey comprising *Grevillea brevicuspis*, *Acacia urophylla*, *A. pulchella*, *Hibbertia hypericoides*, *Xanthorrhoea preissii*, *Kennedia coccinea*, *Tetratheca hirsuta* and species of *Ricinocarpos* and *Gompholobium*. Collections from near the hill ridge were found in outcrop associated herbland with *Stypandra glauca*, *Centrolepis polygyna* and *Drosera* sp.

Mt Cooke was extensively burnt in a wildfire in summer 2000. The notes accompanying N.D. Burrows MC110 record *T. phoenix* as resprouting after fire and portions of R.J. Cranfield 21690 clearly show a number of slender to coarse rootstocks, as well as thicker rhizomes with the remnants of burnt vertical stems.

*Phenology.* Collected in flower in September and October.

*Conservation status.* Recently listed as Priority Two under DEC Conservation Codes for Western Australian Flora. *Tetratheca phoenix* is known only from a single locality within the Monadnocks Conservation Park.

*Etymology.* The epithet *phoenix* is used as a noun in apposition and refers to the discovery of this species for the first time during post-wildfire monitoring at Mt Cooke.

*Affinities.* *Tetratheca phoenix* is morphologically similar to *T. setigera*, *T. fasciculata* and *T. exasperata* in the shape of the stamens and the presence of glandular setae on the pedicels, receptacle and calyx segments, but its phylogenetic position is not yet clear. *Tetratheca phoenix* can be easily distinguished from these species by its prominently papillose-tuberculate stems, which lack setae and simple hairs, but may have scattered small glandular hairs, as well as its linear, more or less glabrous leaves and the long glandular hairs on the ovary. Small, truncate tubercles are seen on the stems of many species of *Tetratheca* (e.g. *T. setigera*, *T. pubescens* Turcz., *T. nuda* Lindl.), especially after the simple hairs at their apex have fallen, but in *T. phoenix* the tubercles are larger, more dense and do not bear simple hairs, even on young growth. In these respects they are most similar to those of *T. paynterae* Alford and *T. pilata* R. Butcher. The linear, more or less glabrous leaves are similar to those of species such



as *T. retrorsa* Joy Thomps. and *T. virgata* Steetz and the dense, long, glandular hairs on the ovary are similar to those observed in *T. nuda* and *T. paucifolia* Joy Thomps.

*Notes.* Of 59 *T. phoenix* flowers examined, 78% were 5-merous and 22% were 6-merous, with both conditions occurring on the same plant. Floral mutations similar to those noted by Thompson (1976: 149) have also been observed, with a dissected flower from the holotype having a split style and at least three locules in the ovary, each with a single ovule. The MEL isotype has a flower with eight petals and a double complement of reproductive parts, apparently the result of an anomalous incomplete bifurcation of the receptacle.

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### References

- Alford, J.J. (1995). Two species of *Tetralthea* (Tremandraceae), from the Coolgardie and Austin Botanical Districts, Western Australia. *Nuytsia* 10(2): 143–149.
- Atkins, K.J. (2006). "Declared Rare and Priority Flora list for Western Australia." (Department of Environment and Conservation: Kensington, Western Australia.)
- Bull, J.P. (2007). *Tetralthea erubescens* (Elaeocarpaceae), a new and geographically restricted species from the Coolgardie Biogeographic Region of south-western Australia. *Nuytsia* 17: 87–96.
- Butcher, R. (2007a). New taxa of 'leafless' *Tetralthea* (Elaeocarpaceae, formerly Tremandraceae) from Western Australia. *Australian Systematic Botany* 20(2): 138–160.
- Butcher, R. (2007b). *Tetralthea pilata* (Elaeocarpaceae), a new and apparently rare species from the Ongerup area of south-west Western Australia. *Nuytsia* 17: 127–134.
- Butcher, R. & Sage, L.W. (2005). *Tetralthea fordiana* (Elaeocarpaceae): a new species from the Pilbara, Western Australia. *Journal of the Royal Society of Western Australia* 88(2): 73–76.
- Department of the Environment and Water Resources (2007). IBRA Version 6.1. <http://www.environment.gov.au/parks/nrs/ibra/version6-1/index.html>. Updated 6<sup>th</sup> February 2007. [accessed 20 August 2007]
- Holmgren, P. K. & Holmgren, N. H. (1998–). Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. <http://sweetgum.nybg.org/ih/> [accessed 21 June 2007]
- Thompson, J. (1976). A revision of the genus *Tetralthea* (Tremandraceae). *Telopea* 1(3): 139–215.
- Western Australian Herbarium (1998–). FloraBase – The Western Australian Flora. Department of Environment and Conservation. <http://florabase.dec.wa.gov.au/> [accessed 20 August 2007]